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EDP Inovação

Key Performance Indicators for Innovation

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Abstract

The work project follows the CEMS Business Project "Key Performance Indicators for Innovation", for EDP Innovation. In order to evaluate the accuracy and sustainability of the company's current KPIs, a detailed analysis of its innovation strategy was developed with respect to EDPI's competitors and relevant frameworks for innovation management. Consequently, disruptive KPIs were suggested to be added to EDP-I's Balanced Scorecard in order to improve the efficiency of the company's innovation processes. Furthermore, some relevant insights about how companies can successfully select, manage and prioritise ideas and fostering innovation within their ranks were discussed.

Keywords: Key Performance Indicators; Innovation Pipeline; Balanced Score Card; Innovation Strategy

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1. BRIEF CONTEXT

a. Client

EDP – Energias de Portugal, S.A

It is a listed company, whose ordinary shares are publicly traded in the "Eurolist by NYSE Euronext Lisbon, Mercado de Cotacoes Oficias". EDP is a vertically integrated utility company. It is the largest generator, distributor and supplier of electricity in Portugal, the third largest electricity generation company in the Iberian Peninsula and one of the largest gas distributors in the Iberian Peninsula. EDP has a relevant presence in the world energy landscape, being present in 14 countries, with 9.7 million electricity customers, 1.4 million gas customers and more than 12 thousand employees around the world. On September 30, 2015, EDP had an installed capacity of 24 GW and generated 46 TWh during 2015, of which 59% came from renewable sources. EDP's strategic goals for 2014-2017 include continue growing, maintaining financial deleveraging, preserving a low risk business profile, improving efficiency and delivering attractive returns – while being a "global energy company, a leader in value creation, innovation and sustainability", as is stated by their vision statement.

EDP – Inovação

EDP Innovation was created in 2006 to provide innovative solutions across the EDP Group. Innovation projects originated in EDP-I and the Business Units are governed by a structured process overseen by the Workgroups and the Innovation Committee. The strategic pillars of EDP-I are controlled risk, focused growth, and superior efficiency. Integrating the strategic scenario with technology and market trends, four key areas have emerged as priorities for innovation: Client-focused solutions, smarter grids, cleaner energy and data leap.

b. Market overview

Renewable Energy Sector

The renewable energy industry remains one of the most vibrant, fast-changing, and transformative sectors of the global economy. In recent years, there have been a number of significant changes to the nature of the energy/utility industry, both globally and in Portugal. Technology improvements, cost declines, and the catalytic influence of new financing structures, have turned the sector into a driver of economic growth. In the industry, growth is steady and shows no sign of slowing down. Between 2005 and 2015, the world added over 1,000 GW of capacity total in the four subsectors geothermal, hydro, solar, and wind. Global clean energy investment, including renewable energy, totalled more than $329 billion in 2015.[1]

c. Current client situation

While there is a general agreement that innovation stems from creativity and risk-taking behaviour, only recently companies have decided to move from a basic trial and error approach to a more structured approach toward innovation. Therefore, along with the need to foster innovation activities, comes the need to properly track those activities. EDP-Innovation's mission is to develop value-added innovation across the EDP Group. However, it is difficult to isolate the impact of such innovation activities from other business activities in terms of overall performance and value-added. As a consequence, the client asked us to help with the development of new performance measurement approaches which would recognize the unique nature of innovation and allow to measure the impact of it on the overall group. From our research, it emerged that three main issues were undermining the capture of value in the innovation pipeline, namely: idea generation, strategy alignment and culture.

[1] 2016 Top Markets Report Renewable Energy A Market Assessment Tool for U.S. Exporters

d. The Business Project challenge

The purpose of the Business Project has mainly two goals: First, analyse the current KPIs for EDP Innovation and assess their sustainability in line with competitors and other frameworks for innovation management. Second, providing EDP Innovation with a standardized and effective method to evaluate and manage projects currently in the pipeline. The team would do it by proposing new disruptive KPIs to be adopted by EDP Innovation, so that the Balanced Scorecard accurately reflects the value added impact of projects currently in the pipeline on the other EDP business units.

2. REFLECTION ON THE WORK DONE AND INDIVIDUAL CONTRIBUTION

a. Problem definition

EDP-Innovation's mission is to develop value-added innovation across the EDP Group. With the purpose of driving profitability to the group, the company's goals are to develop new technologies and services which are core and strategic to the company. EDP aims to do that by leveraging venture capital investments and by establishing different partnerships. Nevertheless, EDP Innovation struggles to isolate the impact of such innovation activities in terms of overall performance and value-added to the entire group and to understand how effective the company is in achieved the proposed objectives.

The next section will cover the methodology used to develop and present the final solutions to the client.

b. Methodology

i. Hypothesis

The main objective of the Business Project was to analyze the current KPIs for EDP Innovation, and assess their sustainability in line with their competitors and other frameworks for innovation management. Following this, we have proposed new disruptive KPIs to be adopted by EDP

Innovation, so that the Balanced Scorecard accurately reflects the value added impact of projects currently in the pipeline on the other EDP Business units

ii. Analysis

Innovation in Energy and Utilities

Nowadays the world is changing at an ever-increasing pace and it will only continue to accelerate, making therefore innovation more important than ever. From a managerial perspective, it is possible to define innovation as the combination of two key features: novelty and change. The first way we can categorize innovation is therefore by differentiating what is new in terms of product, process or the way it is offered. The second way to differentiate innovations is by assessing the importance of the change involved from minor (incremental) to large (revolutionary) (Gailly, 2001). With respect to EDP, it emerged from our interviews that the client's portfolio includes both type of innovations. However, EDP seems to be more prone to incremental projects rather than disruptive ones. Yet, given the nature of the company and the industry in which operates, this is not surprising. Recently, the energy industry has been subject to significant changes, both in Portugal and at the global level. On the one hand, liberalization and market integration have required companies to introduce more profitable technologies in order to increase their efficiency. On the other hand, globalization has triggered mergers and acquisitions creating more concentration in the industry. Furthermore, the growth in electricity demand triggered by the economic advances across the developing world, has emphasized the need of cleaner technologies to address the increasing concerns towards environmental issues. Companies therefore, including EDP – I, are all attempting to develop "best practices" in order to optimize the performance of the electricity industry – and they are using innovation as an instrument to boost the industry's competitiveness and performance.

In order to assess the utility of EDP's innovation process our analysis we used the IEA (2014) *Good Practice Policy Framework for Energy Technology Research, Development, and Demonstration (RD&D)*. The IEA framework (Appendix 1) indicated that the research and development of innovation is only a portion of the total schematic of the innovation system and that demonstration, deployment, and commercialization of the innovation is equally as important. During the commercialization and diffusion phases, feedbacks both from market and technology users can generate spilllover benefits, including additional RD&D. Additionally, the framework highlighted the importance of "intelligent choice of energy RD&D priorities" since it will "facilitate market deployment of new and improved technologies". However, "priority setting is an ongoing process that requires regular evaluations" (Chiavari, Joana & Tam, Cecilia, 2014). These two components, as well as having effective strategic partnerships and an effective governance structure and successful institutionalization of technology innovation are key components of a successful R&D strategy for a utility company. According to the IEA framework, successful R&D institutions for energy innovation share the following five governance characteristics: A clearly defined mission linked to a larger systems perspective; Leaders with proven scientific and managerial excellence; Entrepreneurial culture that encourages both competition and collaboration; Management structure that balances independence and accountability; Stable and predictable funding.

Yet, although these five characteristics were constant among successful R&D institutions, there appeared to be no single accepted ways to measure the innovativeness of an organization. However, literature and industry practices have proposed many metrics to measure and benchmark innovation performance. Input metrics, process metrics, and output metrics are all utilized in R&D measurement and evaluation. Concerning input metrics, some examples are: the number of ideas generated, the number of partnerships initiated and R&D and innovation spending among others.

Process metrics include the failure rate, the stage-gate pass rates, and the average time from idea to approval whereas output metrics could include the number of new customers, ROI on innovation spending, or total revenue from an innovative product or service, among others.

The Competitors

Although awareness about environmental issues is heightening, a world of clean and safe energy is not around the corner[2]. Yet, the European electricity supply industry is facing rapid and severe changes to its traditional business model which, more than ever, will affect the role of innovation within utility companies. In order to have a general sense of the multiple approaches toward innovation pursued by different players in the European electricity marketplace, our analysis is based on the ESMT Innovation Index (Appendix 2). The index measures the innovation activities of 16 majors European utilities[3] between 2007 and 2014. Besides R&D expenditure, patents and research areas, the index also take into account indicators for process innovation, particularly the utilities' performance regarding productivity and sustainability.

Between 2007 and 2011, the combined R&D budget of the companies analysed, grew by 47 percent – from €1.16bn to €1.71bn (Appendix 3). Yet, R&D budget declined by almost 10 percent per year between 2011 and 2013. Nevertheless, this trend has been reversed in 2014, where expenditures rose by 4 percent. It is noteworthy to mention that, with a R&D budget of €650m in 2014, EDF accounts for more than 40% of the total combined R&D budget and that over the time period 2007-2014, Iberdrola almost tripled its research expenditures exceeding €170m in 2014. Generally, it can be concluded that companies in the sample have readjusted and focused their research activities between 2012 and 2014; interestingly, the total number of patents issued in 2014 (80) is

[2] IEA. (2014), *World Energy Outlook 2014*, IEA, Paris

[3] Axpo, CEZ, Dong, E.ON, EDF, EDP, EnBW, Enel, Fortum, Engie, Iberdrola, RWE, SSE, Statkraft, Vattenfall, Verbund

approximately one-fifth of those issued in 2010 (381). One possible explanation for this drop should be sought in the increasing interest of companies towards open innovation and co-investments into promising start-ups located around Silicon Valley.

According to the ESMT Index Analysis, the strategic posture of the 16 energy utilities can be categorized into three different specific clusters (Appendix 4). The first group, which contains companies with a strong focus on research activities (large amount of R&D expenditure and wide array of research areas) or collaborations, and a successful track record on patents over the time period 2007-2011 include firms such as EDF, RWE, Fortrum while Enel joined its peers in 2014. The second cluster, which contains companies with a lower focus on in-house research, but with successful implementation of innovative processes and technologies includes EDP, which had the highest score in the overall ranking of the ESMT Index in 2012 as well as Iberdrola and Statkraft. By 2014, this cluster experienced some changes that better represent the strategy of those companies. For instance, while Statkraft and Dong – that have moved from the third cluster to the second cluster – are pursuing a "pure" dissemination strategy, Iberdrola has moved from a straightforward dissemination position to hybrid innovator with a strong focus on R&D activities. One of the conclusions to be drawn for this is that some utilities are trying to purse a hybrid strategy which combine the benefits of both R&D-driven strategy and nimble implementation of innovative processes. The third cluster, companies with a modest focus on R&D, but also with a moderate performance in productivity and/or sustainability, comprehends roughly the same companies for the entire period 2007-2014. Interestingly, E.ON is included in this group. Nevertheless, some of the innovative projects in its pipeline, for instance offshore wind farms, are not yet embodied in the metrics but might translated soon into higher performance scores. However, since 2010, E. ON has experienced a decrease in its EBITDA of approximately 54%. Hence, for E.ON, the strategic importance of fostering innovation in one direction seems to be circumscribed.

Finally, many of the European energy utilities have started considering new approaches toward innovation: accelerators, corporate incubators, venture capital units and co-investments in start-ups are no longer solely the prerogative of other industries (Appendix 5). Enel and E.ON have set their own incubators and accelerators, while Iberdrola, since 2008 has spent €50m in disruptive technologies through its corporate venture capital program, Perseo. However, old innovation approaches will not completely disappear, but they will coexist in the future, as demonstrated by EDF with its new research center[4].

Insights at EDP Innovation

In order to better address the problems of our client and to further have a general sense of what innovation meant inside the company, we conducted interviews with three different managers from diverse strategic areas – Energy Storage, Cleaner Energy and Smarter Grids – and one with an Executive Board Member of EDP Innovation (Appendix 6). Thanks to this interviews, the team was able to recognize and frame three main issues within EDP – I, namely: idea generation, strategy alignment and culture. The other takeaways from the interviews and its implications will be discussed in the next paragraphs.

Innovation projects originating at EDP-I and the business units are governed by a structured process, which is overseen by the workgroups and the innovation committee (Annex 13). The first step of this process is sourcing, followed by screening, analysis and delivery and implementation – ending up in closure or hand-off to other business units. However, in order to perform this process successfully, generating valuable ideas is crucial. After performing our interviews with the company's managers, we have identified issues concerning idea generation that can affect the

[4] EDF R&D has got a new research center in Palaiseau on the Paris-Saclay campus, which will be the largest industrial research and vocational training center in Europe.

success of this process. The potential reasons for these issues were about the quantity, quality and selection of ideas.

EDP-I follows a model of open innovation, sourcing innovative ideas at the global level, and leveraging its innovation effort with meaningful partnerships. Thus, if ideas can come from a plenitude of sources, then logically the higher the quantity of ideas generated, the higher the probability to achieve a higher idea quality. Additionally, an advantage of open innovation is the idea that the value of the best idea generated generally increases with the variability of the ideas received. Moreover, an effective idea selection is critical to systematic innovation. However, is the selection process being executed by the right people making the crucial decisions in a timely manner, so that innovation continuously advances? One of the factors that indicate that the process is not operating at maximum efficiency is the existence of a substantial overlap in EDP-I's project origination and selection process, creating an unclear differentiation between the business units and the project teams.

Furthermore, we have also identified issues regarding the strategic alignment of EDP-I, and the lack of a clear and aligned purpose of the company. By approaching the different managers of different areas within EDP-I, we realized that the purpose of EDP-I was not always clear among all of the business units, and this was reflected in how innovation is structured within the group. One of the key insights from our interviews was that, the rationale behind open innovation is well perceived and well embraced on the different teams - however, managers expressed their wish to have a more standardized process, in order to move more efficiently through the innovation pipeline.

Finally, the last issue we have identified is cultural, and related with the existence of a conservative mind-set and the presence of communication problems within the EDP Group. On the one hand, one of the main purposes of the board of EDP-I is to promote innovation within the Group. Through

the creation of EDP Ventures and the open innovation philosophy, there was an ambition to maximize the global innovation effort, but only with a light internal structure to support it. However, more innovation comes with more risk, which is not aligned with the culture in EDP-I, still anchored to a very traditional conservative mind-set of utility companies and promoting an extremely controlled risk exposure. Thus, innovation needs to be promoted within the whole EDP Group, in order to overcome this conservative attitude that is still very present.

On the other hand, in order to assess the effectiveness of possible changes in these three strategic issues undermining the capture of value by EDP-I, new metrics need to be incorporated in the company's balanced scorecard, their performance management tool. Whereas an effective balanced scorecard incorporates insights on the inputs, processes, outputs and outcomes of the innovation process, EDP-I only includes financial and operational indicators for their analysis of the projects currently in the pipeline.

iii. Methodology

This section will highlight how the team has structured the study and reached the final outcome. The analysis is separated in three main processes.

In the first part, the team focused its efforts at analysing the industry's best practices, by benchmarking the 16 major European utility companies between 2007 and 2014 and researching about the entire utilities industry. Subsequently, by using the IEA Framework and by performing the interviews, we have assessed the EDP-I's current innovation process. Lastly, as a result of our benchmarking, research and analysis efforts we have proposed a new Balanced Score Card to be used by EDP Innovation. The new Balanced Scorecard would incorporate four elements namely: Portfolio Projects Visualization (PPV), New Relevant KPIs, EDP Innovation Index and Portfolio Project Index (PPI) which is a sum up of the characteristics of each project given by the "Project Evaluation Scorecard" (PES). (Annex 7)

c. Recommendations to the company

As mentioned in the previous section, the current issues identified within EDP Innovation can be condensed to mainly three points: idea generation, strategy alignment and culture. Yet, there are several recommendations that could help EDP-I improve its current internal situation.

Starting from the first point, idea generation, it emerged from our analysis that the process appeared to be not as efficient as it should be. Potential reasons of this must be found in three elements: quality or quantity of projects or from the selection process itself. Statistically speaking, the more ideas are generated, the more likely is to pick up the "killer" one. And the more diverse is the source, the higher the quality of ideas generated.

However, ambiguous splitting of work and responsibilities throughout the project origination and selection process have been identified as the main pain points. In fact, due to the small number of staff, there is no clear differentiation between business units and project teams, which could potentially lead to a substantial overlap between involved parties and ultimately negatively affect the selection of opportunities. To effectively tackle this problem, the first step is to outline clear roles and responsibilities in order to lead the innovation agenda. Each step of the project selection process should be clearly assigned to a predefined team. This, however, will at some point require more manpower, especially in business units that are clearly understaffed, such as Energy Storage. However, although manpower plays an important role in the idea generation, they are not solely responsible for it. In fact, having well-organized processes in place, contributes significantly to the success of the final outcome. Therefore, EDP-I, in order to further improve this process and remove potential inefficiencies within it, should introduce KPIs and targets, with the purpose of driving the right behaviour among decision makers at each level. Specifically, EDP-I should introduce stage-gate pass rates for each step of the selection process. Furthermore, the number of new ideas

inflowing the screening process should be linked to the employees that are currently available to work on them. By doing that, it will be easier to observe the urgency of employee needs.

The next issue – strategy alignment – can and should be enhanced by several actions. In fact, the purpose of EDP Innovation is not always clear among all the business units. This is reflected, for instance, in how innovation is structured within the group. In fact, although open innovation is well perceived and well embraced within the group, according to employees, a clearer direction in term of vision would be more than welcome.

Therefore, in order to tackle this issue first of all, the (long-term) innovation vision of employees should be standardized. From our interviews, it emerged that "Passing on projects to other business units" is seen as the ultimate goal of EDP-I for many employees. Clearly, this is far to be an effective and intrinsic way to incentivize the staff. Moreover, aligning the strategy toward a specific set of goals for the future, can foster the process of discovering forthcoming trends. This in turn will help EDP-I being better prepared for the future and at the same time will help reducing the intrinsic risk and unpredictability associated with innovation and thus ultimately improve the allocation of resources.

The third issue –culture – represents another burden for EDP – I. Unsupportive culture and climate are often quoted by CEOs as the most common internal organizational barrier to effective innovation, in particular regarding the ability of projects to fail without penalties[5].

Although one of the points in the board agenda is to promote and nurture the open innovation philosophy within the group, more innovation comes with more risk and the culture seems still to be anchored to a very conservative mind-set.

[5] IBM (2006), Expanding the Innovation: The Global CEO Study 2006, Armonk, NY, IBM Business Consulting Services, p. 30.

While it would be naïve believing that a corporate mind-set can be altered from one day to another, it is reasonable to think that a very risk-adverse culture can be slowly influenced and ultimately soften.

However, this cultural issue can be tackled by increasing promotion within the company. With respect to this, EDP should foster the concept of learning organization, meaning that employees must be able to share ideas and knowledge freely across all different departments and learn from failures. Furthermore, the company culture should be more inclined to be supportive with respect to innovative projects: for instance, every major innovation project should be sponsored by a top-management executive who is visibly invested in its success. Additionally, a specific reward system designed to recognize employees for their specific innovation efforts could be introduced. Finally, the role of training, for instance how to assess the feasibility of an idea and how to present it to mangers, and the motivation of the project owners should not be underestimated. As an overall KPI for checking on cultural improvements within the group, the percentage of employees that is aware of processes within EDP – I could be measured on a constant basis. The Portfolio Projects Visualization (Annex 8) – which give a quick overview of the rank of each project and its characteristics – could be used as an additional tool to increase awareness across all the business units. Overall, in the long run, this approach will not only lead to more effective knowledge sharing but also to an indirect incentive for EDP – I's employees.

A different and more general recommendation with regard to common practices in the industry is to broaden the scope (or variance) of innovation. The trend is pivoting from focusing solely on traditional business units (*managed innovation*) – for instance increasing the operational efficiency of a coal-fired power plant – towards a more open approach that incorporates exploring completely new fields (*diverse innovation*) – for example co-financing accelerators specialized in specific

solutions[6]. By increasing the variance of inputs and expanding the pool of people that generate ideas in the respective new fields, new revenue streams can be accessed and thus a competitive edge can be created. By financing *diverse* forms of innovation, EDP can send a signal to both external and internal parties: Externally – to stakeholders, shareholders and investors – that the company is in the right track to tackle the challenges of the market; internally – to middle management and employees – that a new mind-set is being embraced.

After having addressed the current issues within EDP – I and having proposed our recommendations, it is now possible to analyse the current balance scorecard.

The balanced scorecard currently used by EDP-I incorporates almost exclusively financial measures, which just partially reflect the impact of innovation. In order to do so, input, process and output metrics should be introduced. With respect to KPIs, although there are various useful KPIs to choose from (Appendix 8) we consider the following four as most beneficial: Regarding input metrics, the number of new ideas generated should be actively used as a measure of Innovation. As explained above, an increase of ideas generated is the key to strengthen innovation activities and develop a competitive edge. Considering process metrics, the number of ideas approved vs. the number of ideas implemented appears to be a valuable stage-gate measure to monitor the efficiency of decision processes. Absolute R&D Productivity[7], tries to quantify R&D's overall performance and to shed light on separate aspects of productivity. The usefulness of this metric lies in the way it drives the right behaviour namely, better forecast and management's attention on the ongoing most critical project's, faster time to market and efficient execution. As suggested by employees during our interviews, the number of new products or services introduced could be added to the

[6] EnBW co-finances the Berlin branch of global accelerator Startup Bootcamp, which specializes on energy and transport solutions.

[7] multiply a project's total gross contribution by its rate of maturation and then divide the result by the project's R&D cost

scorecard as effective output metric. The new KPIs abovementioned could be introduced directly in the previous scorecard without changing its structure.

Additionally, we proposed EDP a new scorecard to equally evaluate each single project based on the same metrics: Financial, Organization, Project Risk and Market. All of these sections have sub-sections (Appendix 9). For each metric, the evaluator of the project should give a score from 0 (very low) to 5 (very high). The weight of each metric should be discussed within EDP, however the total sum of each weight should equal 100%. The final rating for each section will be given by the score of each sub-section times its weight. In case a project score in the Risk section is less than zero, the interpretation would be that the mitigation factors offset the risk factors. Finally, the overall project score will be the result of the sum of all the final ratings in each section – Financial, Organization and Market – minus the sum of the residual risk – risk factors minus mitigation factors (Appendix 9).

Beside the evaluation scorecard, two additional elements have been suggested to the client, namely: Portfolio Project Visualization and EDP Innovation Index. The former component tries to rank projects according to their level of change – incremental or radical –, their level of newness – Process or Product/Market – and their value (€). Values on both axis range from -10 to 10. According to the level of change or newness, scores must be given. For instance, an extremely disruptive innovation will receive a score of 10, while a strong incremental innovation will receive a score of -10. Values between this range are allowed. Similarly, if the innovation is related with a process, a score less than -5 would be given, if instead is more related with products or new markets the project will receive a score higher than 5. Values between this set are allowed as well. As a final remark, let us mentioned that the two categories above could be interdependent. In fact while product innovation are more likely to be present in the early stages, process innovation are more prone to appear on the later stages.

As a final point, let us dive in into the second element suggested to EDP – I. The EDP Index is designed to monitor the level of innovation throughout a specific time period. It takes into consideration 4 factors: EBITDA, ideas approved VS idea implemented, absolute R&D productivity and number of new product/services. However, those KPIs and their weights in the index, might be changed according to the importance EDP gives them. The indicators are taken directly from the current scorecard. Each indicator will have a score – Indicator Score – which represents the deviation from the actual value versus the budgeted one (in percentage) times its weight. The final EDP Innovation Index will simply be the sum of each Indicator Score. (Annex 10)

By looking at the data it is possible to draw that EDP's percentage of EBITDA invested in R&D is substantially lower when compared to its main competitors. Having in mind that there is no direct correlation between the R&D expenditure and sales growth and that therefore R&D is only a necessary condition to compete, but not a sufficient one to succeed, as a final recommendation we strongly encourage increasing the R&D investment in order to keep up with the direct competition.

d. Concerns (shortcomings, implementation problem expected)

The first issue we faced during our project was related with the scope of the problem. At the beginning, the boundaries of our scope were a bit shady. The angle we were asked to cover was fairly wide and it seemed we were trying to "boil the ocean". In particular, there was no clear understanding whether we had to analyse the projects already within the pipeline, or throughout all the phases of the process. On top of that, the fact that we weren't able to have a clear and straightforward idea about the vision and the purpose of EDP Innovation – "creating innovative solutions" was somewhat vague – it has only made the scope even harder to define.

However, after having framed the problem our initial idea was to collect and analyse as many balance scorecards as possible from the competitors. We spent almost two weeks to try to contact

employees from different companies within and outside the industry. Yet, soon we realized our second problem: the demand we were requesting was too ambitions. In fact, those documents were either confidential or extremely important from a strategical point of view.

The third issues was related with the interviews within EDP. The sample of the interviewees probably was not extremely large because those were the only people the company allowed us to interview. Nevertheless, the quality of the answers extrapolated from the interviews offset the quantity of interviewees.

Lastly, although we consider our suggestions and KPIs to be relatively easy to implement in terms of cost and resources employed and even if EDP Innovation would decide to ultimately implement them, our concern would be more about the use of those tools. The main risk is that in the long run, the lack of engagement from the senior management could frame the decision-making too much and make the all the decision process just a mere additional point in their "to-do-list".

e. Individual contribution

From the initial framing of the problem, throughout all the process of problem solving and to the actual conclusions, my commitment in the project has been high. Data gathering, manipulation and extraction has been performed solely by me as well as the finalisation of the benchmarking analysis. The data I found came both from the ESMT Index Report and further analyses based on the Annual reports of several competitors. In order to manipulate the data and extract information, I used Excel Office 2013.

Yet, the perk of my work could be represented by the conception of the Portfolio Balanced Scorecard and its actual creation and design. Please note that the Portfolio Balance Scorecard (Annex 9) includes four elements namely: Portfolio Projects Visualization (PPV), Current Scorecard with new KPIs, EDP Innovation Index and Portfolio Project Index (PPI) which is a sum up of the characteristics of each project given by the "Project Evaluation Scorecard" (PES).

The driving justifications behind the realisation of this tool were mainly two: making possible to rank projects throughout all the pipeline in order prioritize important projects and increasing the awareness across all the group about the projects currently undertaken by EDP – I.

The process of research started by analysing several papers about the concept of balance scorecard. Clearly, the very initial source I read up was the first article published about this topic. Norton and Kaplan introduced the Balance Scorecard in a 1992 Harvard Business Review article called "The Balanced Scorecard: Measures that Drive Performance". The article was based on a multi-company research project to study performance measurement in companies whose intangible assets played a central role in value creation (Nolan Norton Institute, 1991). The primary focus of initial balanced scorecard was to be a control tool for managers. Yet, the concept over the time has evolved – from a management system and communication tool, to a resource to connect strategic management underlining, however, the importance of strategic learning which is related to processes of innovation and hence inevitably related with human factors within companies – up till now where this tool takes into consideration the strategic relationships with external organizations as well (Rangarajan, 2014). Therefore, for the development of the final PES and consequently PPI, I took into consideration all of these changes and I translated them inside the scorecard.

With respect to my first driving rationale, our client implicitly showed interest in finding new approaches in managing a really broad and diverse pipeline such as the one EDP – I has. In fact, most of the time companies have too many projects to deal but not enough resources to commit in order to do them well. That was precisely the case of EDP. With more than 60 innovative projects, I though the pipeline was kind of crowded. Therefore, developing a scorecard that could have helped in separating promising projects from less promising ones would have been more than welcomed from the client. Hence, for the PES, my choice has fallen upon the four metrics aforementioned – Financial, Organizational, Project Risk and Market – and their respective 10 sub-

categories. Those metrics has been chosen after having read an insightful paper called "Optimizing the stage-gate process" (Cooper, 2002). As suggested by the authors, I tried to select the metrics according to three specific effective criteria: they must be operational (easy to use), realistic (they must make use of available information) and at the same time discriminating (they differentiate between good and bad projects).

In brief, the ultimate goal of the project evaluation scorecard was to help our client answering important questions – such as "Does this project improve the overall portfolio?", "Does this project fit the strategic goals of the group?", "Is this project drying resources from other important projects?" etc. – for each opportunity in the pipeline.

The Portfolio Project Index (PPI) is a direct consequence of the PPE since it includes in a nutshell all the most relevant projects and the respective names of their owners.

Finally, the second driving motivation behind the Portfolio Balanced Scorecard was to generate more awareness about the projects pursued by EDP – I. I believed that by using two user friendly and catchy visuals, namely EDP Innovation Index and Project Portfolio Visualisation, employees would have no longer considered EDP- I as a "black-box". In fact, by adding the above mentioned tools in the current scorecard, employees have now a quick overview about the current state of innovation within the group, its architects and its strategic posture. Employees therefore can see the tangible existence of the projects, take inspiration from the role models and eventually participate in the project with recommendations and actions.

3. ACADEMIC DISCUSSION

a. Link with Strategy

Nowadays the world is changing at an ever-increasing pace and it will only continue to accelerate. Even those industries which were perceived as immune to change, as for instance consulting industry, nowadays have to respond quickly to threats of disruption (Christensen, 2013). As a

result, companies find that their strategies need almost constant reinvention - either because the old assumptions are no longer valid, or because the previous strategy has been imitated and neutralized by competitors, or because technological developments and globalization offer unanticipated opportunities. Strategic innovation refers to this process of reinventing strategies (Govindarajan, V. , 2016). Yet, innovations are the products of entrepreneurs, who are able to see opportunities (Shumpeter, 1934), decide which ones to pursue and mobilize resource accordingly (Barringer, B.R. & Bluedorn, 1991). Innovative firms must therefore develop the capability of acting as corporate entrepreneurs, identifying opportunities, assessing and exploiting them (Hitt & Sexton, 2001). However, if there is no effective way to filter and prioritize those opportunities, this capability can be useless. This means that companies must develop a proper process to: on the one hand separate ideal opportunities – those that are the best fit with their resources and strategic objective – from bad ones, on the other to handle and capture those opportunities effectively. Yet, firms should understand how projects based on innovation opportunities are different from traditional ones, and what it means in terms of execution. So, how can companies successfully select, manage and prioritise ideas and fostering innovation within their ranks?

b. Relevant theories and empirical studies

Successful innovation gives companies an advantage in today's highly competitive world. Yet, achieving sustainable competitive advantage through innovation requires a specific multi-dimensional approach (Goffin and Mitchell, 2010). The Pentathlon Framework consists of five elements, namely: (i) innovation strategy, (ii) idea generation, (iii) prioritisation and selection of ideas, (iv) implementation of the ideas selected, (v) people and organization. Innovation strategy defines the objectives of innovation and identifies responsibilities for developing solutions within specified areas (Scott D. and Sinfield, 2008). However, innovation goals and objectives must be aligned with the overall company's strategy, otherwise innovation could become an end *per se*

rather than a means of achieving existing strategic objectives (Gailly, 2011). This, requires going beyond all-too-common generalities such as "We must innovate to grow, "We innovate to create value" or "We need to stay ahead of competitors" (Pisano, 2015). For instance Apple focused its innovation efforts on making its products easier to use than competitors and providing a continuous user experience across its devices. The second element of the framework is about managing creativity and knowledge. According to Dougherty, to promote a smooth flowing of knowledge and ideas, an organization needs a boundless structure. In fact, "when boundaries in an organization and between an organization and its environment melt down, it is easy to expand sense making" (Meckl and Fanchen, 2008). For instance, companies, including EDP, have started using an open approach toward innovation. Yet, business creativity requires originating ideas that have a commercial value. Within this context, according to the framework, there are three types of innovation to consider, namely normative, exploratory and serendipitous[8].

The third element of the framework includes prioritisation and selection of ideas. Clearly, not all the ideas generated will add the same value for the organisation. Hence, it is crucial to evaluate regularly whether the projects currently in the pipeline are worth doing or not. With respect to this, a stage-gate process could help to do it in a systematic way (Cooper, 1990). With this approach, projects are divided in phases – stages- separated by decision points – gates. By doing that, it is possible to replace a single upfront go/no-go investment decision by a prescheduled structure of more educated and less revocable decisions to commit more resources or not. The value of this model is that it allows pivoting or stopping a project early. However, an excess of standardization in the review process, could frame the decision-making too much and make the all process just a

[8] Normative where an existing problem or complaint is resolved; Exploratory where new opportunities are identified; Serendipitous where accident and good fortune combine to create a new idea

mere bureaucratic exercise (Lock, D. ,2016). Finally, projects must be evaluated not only for their intrinsic value but also for their strategic fit with respect to the entire portfolio (Mikkola, 2001). For example, in the late 80s Pfizer was testing a new drug for the treatment of high pressure (Ketih, 2000). Yet the drug did not pass "Phase I". However, the – noticeable – side effects reported by some male patients allowed a pivoting of the project. After several years Viagra came into the market.

Once the idea has been selected the fourth stage – implementation – begins. According to Goffin, and Mitchell, effective implementation can be performed by using a standard project management techniques with some additional features – appraisal, mitigation, decision, and review[9] - in order to manage the higher levels of risk and uncertainty which are usually associated with innovation. However, having an effective process will not take away the ambiguities and uncertainties of innovation. In fact, in the end all the decisions are taken by individuals which for definition are subjective and biased (Nickerson, Raymond, 1998).

The fifth element is people and organisation. Maintaining momentum and direction for innovation requires well-designed environments which encourage entrepreneurial mind-set amongst workers (Holland , 2014). From the initial recruitment through their performance management, from reward to individual development, all aspect must be taken into consideration.

c. Implications and future research

Fostering an innovative environment and leveraging valuable ideas that result in viable new products and processes have proven to be quite a challenge (Leavitt, 1994). However, the ability

[9] Appraisal – this consists of understanding the range of risks, assessing their impact and estimating the likelihood of occurrence. This results in what is termed the 'gross risk'. Mitigation – at this stage, plans are put in place and actions take to reduce or avert risks as far as possible. This leads to the 'net risk'. Decision – considering the net risk, the range of other activities in the business and the impact on business direction, whether or not to precede must now be considered. Review – ongoing monitoring of these three stages should continue throughout the project.

to sustain motivation can be influenced by the provision of rewards, training and feedback. Monetary incentives don't always work out (Gneezy and Rey-Biel, 2011), especially in intrinsic-driven activities such as innovation. Paradoxically, the monetary incentives can effectively crowd-out the task's intrinsic motivation and reduce future interest in the activity (Frey and Jegen 2001). Instead, recognition and supportive culture - which reward the accomplishment of people and tolerates failure – can act as strong motivators. For instance, 3M relies heavily on peer recognition to encourage innovation. In addition to that, it celebrates success stories and propagates tales of innovation and contribution[10]. IBM instead, has an event called "Innovation Jam" where IBM employees, family members and customers are invited to a moderated online brain-storming session. EDP, could take inspiration from these examples and create similar activities indeed.

Google, instead, praises employees to spend 20% of their paid time on side projects unrelated to their core task. However, there are no real evidence that this contributes more to the firm than its costs. Future research could be useful to investigate which approach generates more productivity and how this could be balanced among different demographic cohorts.

Fostering the right climate and culture for innovation is not the only success factor though. In fact, effective innovators manage the innovation process by both being able to distinguish between bad and good ideas, and pivoting or stopping a project in time. However, while this process allows for a structured approach to idea evaluation, it is limited to the degree that it cannot be formed in a way that fits all types of innovation. For instance, a company can be pursuing both exploitation and exploration opportunities simultaneously. In such case, the design of the stages becomes limited as it may not be adequate for both innovation approaches.

[10] Kimberley Lopez, Knowledge Management specialist at the American Productivity and Quality Center (APQC).

Managing the processes and nurturing innovation by using a standardized approach, is one of the suggestions which has been given to EDP. However, a too standardized approach might frame the decision-making too much. Equally, the same evaluation process might not be applicable between different industries, between B2B and B2C businesses or for innovations among products, services and processes.

Sometimes, innovation is more related with people rather than with process. However, not every innovation results in the next big thing. This implies that often process are cancelled, blocked or postponed. How do companies handle the people who work on that project, in terms of feedback, resource management and motivation? Companies, including EDP, should create a repository or an idea vault for those ideas/projects which have been killed. Employees should have access to these idea banks and managers should periodically scan these repositories.

Finally, having an innovation approach in place, such as the one proposed by Goffin, K. and Mitchell, allows organizations to nurture innovation by thinking in "new boxes" rather than "outside the box" (Brabandere, 2013). Yet, even an optimal innovation process will not completely remove the risks and uncertainties of innovations. In fact, companies are still driven by human beings which by nature are subject to biases and anchoring processes. Firms need therefore to develop the ability to listen to dissenting voices, question them a priori and challenge their orthodoxies. Unfortunately, there is no specific approach that can be used, yet understanding it is already a good start.

In conclusion, there is no magic formula to deal with innovation and what matters is not always to be right, but to be wrong less often than others and to adjust more quickly when it happens (Gailly, 2011).

4. PERSONAL REFLECTION

a. Personal Experience

i. Key strengths & weaknesses observable during the project

If I could sum up in a nutshell the experience I had with my team, I would definitely quote one of my favourite basketball players and one of the most successful athletes of all time: "Talent wins games, but teamwork and intelligence win championships" – Michael Jordan.

Before actually start working, each one of us did the MBTI[11] test. The results shown that the team was quite balanced (ENFP, ENTP, ISTJ, and ISTJ). Starting from the strengths, I would say that the team was bounded and stable over time. Since the very beginning we got along quite well. We mutually complemented each other and although we frequently raise doubts and disagreements – very common in group dynamics – we have always being respectful and fair.

Honestly, I struggled to find really relevant weaknesses. Yet, sometimes we had some problems with time schedule, not only because it was difficult to some us to carve out time in specific days, but also because of different cultures. Moreover, at the very beginning, meetings were not extremely productive. However, throughout the semester we learnt how to structure meetings and make them more efficient by using a simple agenda with three points: planned, progress and problems.

ii. Plan to develop of your areas of improvement

This project not only gave me the opportunity to understand what I really valued in a team work but also which areas of improvement I should focus on. Personally, I have identified mainly two of them. Firstly, sometimes I find it difficult to focus. Especially when task are repetitive and away from broader concept, it's hard for me to maintain high interest. Secondly, I tend not to take things

[11] The Myers-Briggs Type Indicator (MBTI) is a widely-used personality inventory, or test, employed in vocational, educational, and psychotherapy settings to evaluate personality type in adolescents and adults age 14 and older.

at their face value but I always look for underlying motives in even the simple things. Working more with people different from me, will extremely benefit my personality and my set of skills. Different way of approaching problems and drawing solutions, different cultures and different way to deal with stress are just few of the possible experiences which will help me improve my shortcomings.

b. Benefit of hindsight: What added most value? What should have been done differently?

I believe that as I mentioned before what really added most value to our project was that the team was bounded and stable over time. We were able to have a laugh or a joke even in the most stressful situations. This has helped us, on the one hand to alleviate the pressure of the deadlines and to avoid unnecessary edginess. On the other hand, it allowed us to have a break and take a "helicopter view" from the problem itself. In conclusion, I believe that the abovementioned points not only have increased the quality of our .work, but also, and probably even more important, they have put some solid basis to a concrete and rewarding friendship among us.

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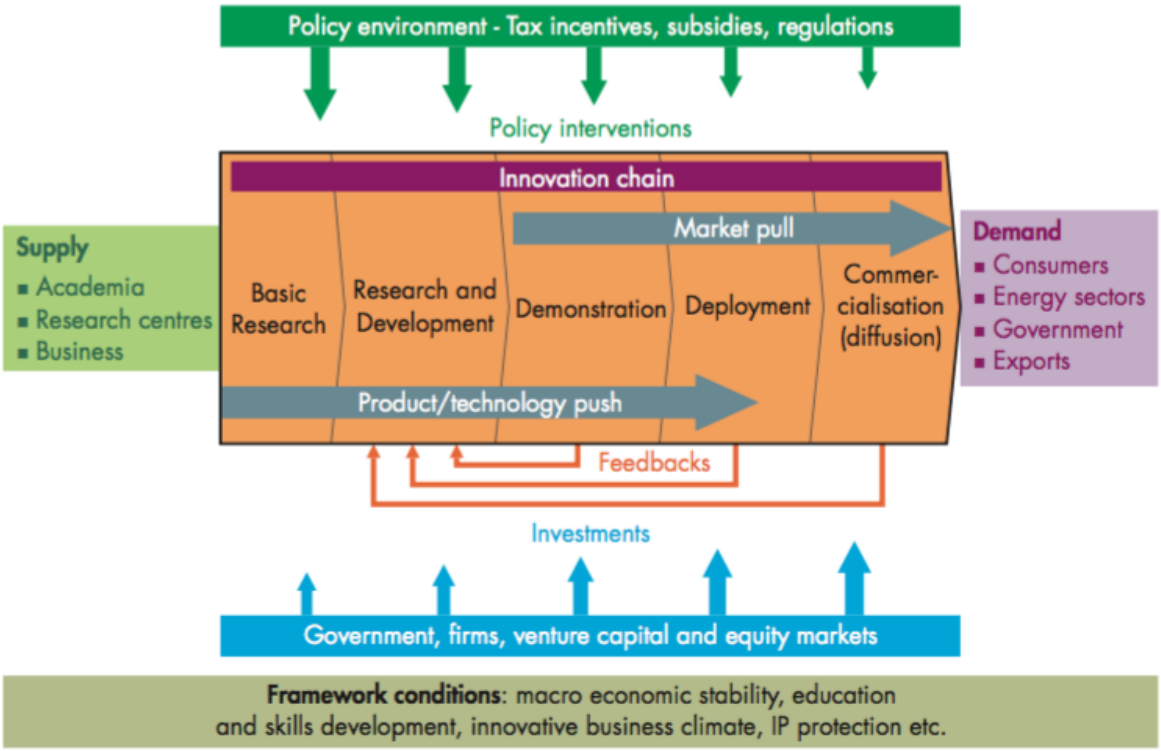
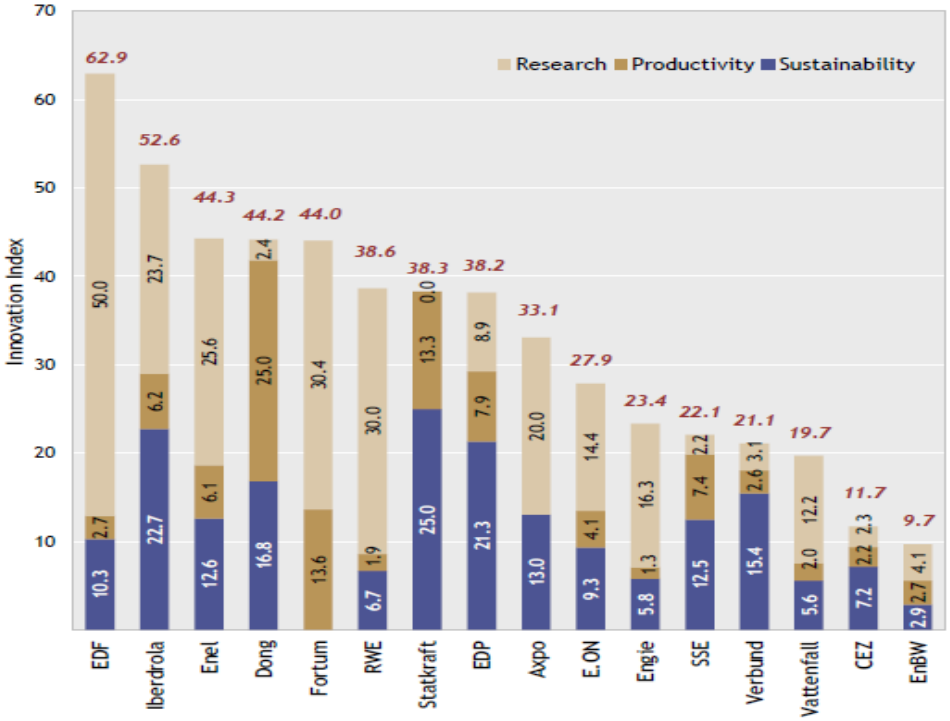
Appendix

Appendix 1: IEA Framework - Schematic of the innovation system



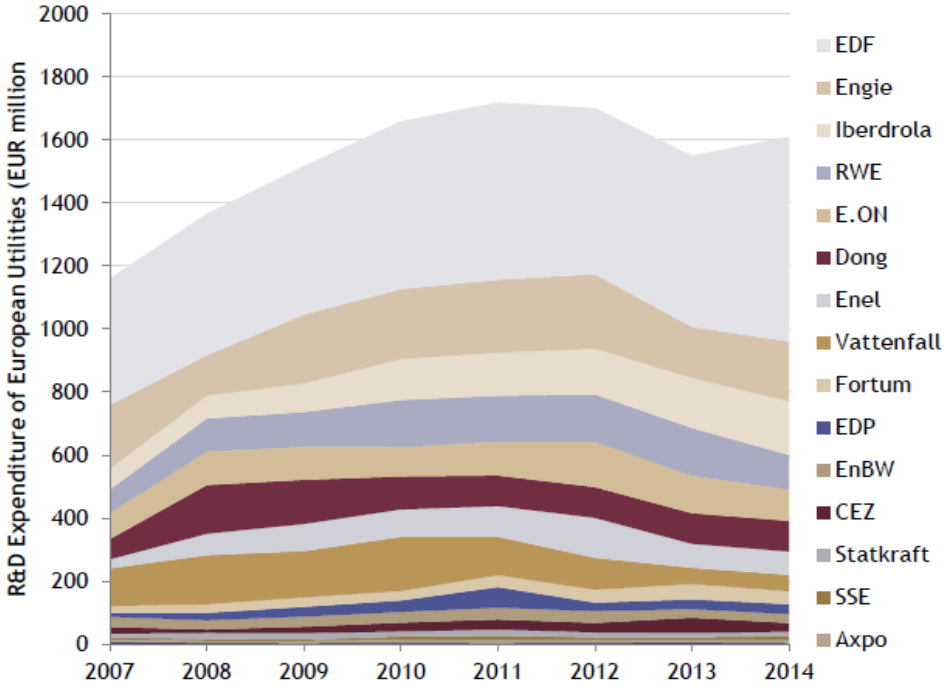
Source: IEA (2008)

Appendix 2: Ranking and composition of ESMT Innovation Index 2012



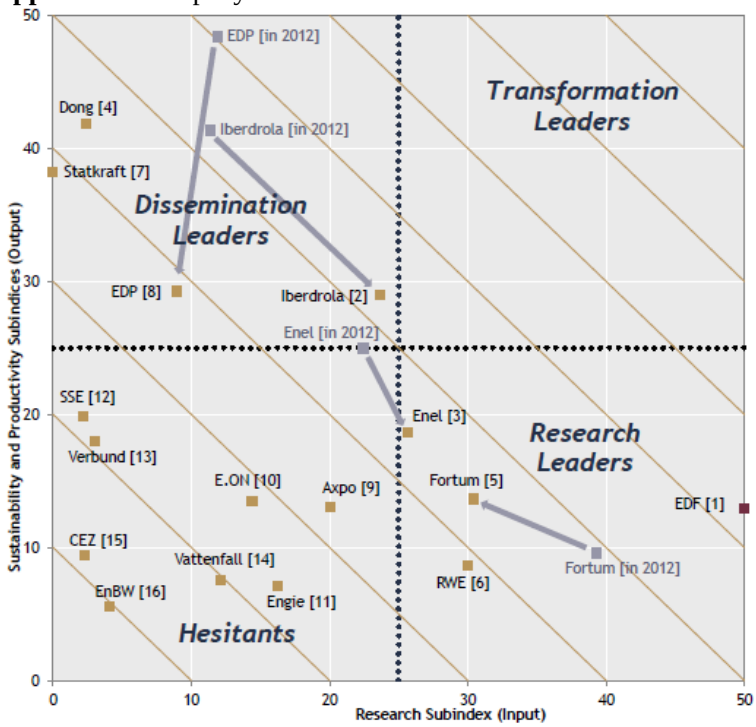
Source: ESMT Analysis (2015)

Appendix 3: R&D spending of major European energy companies



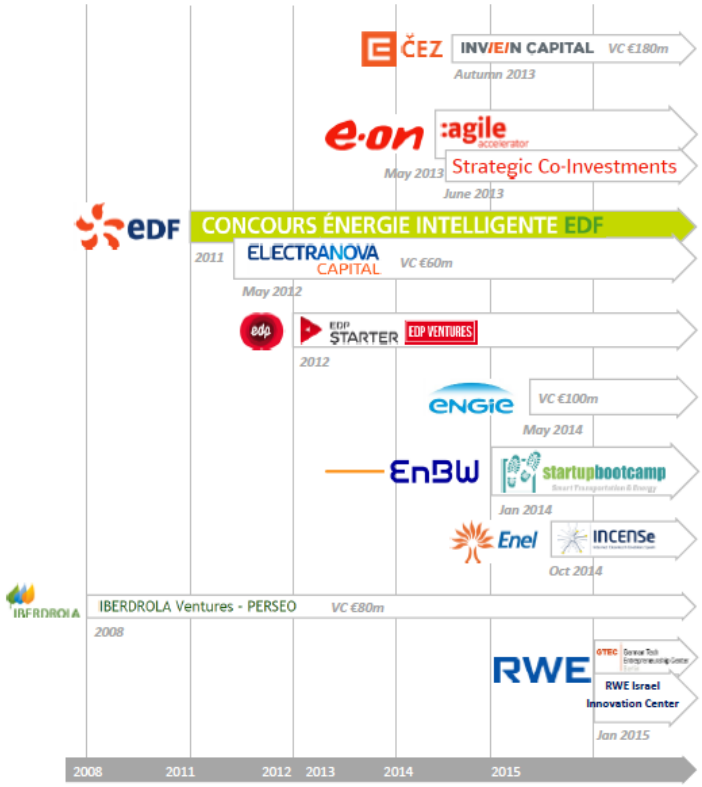
Source: ESMT Analysis (2015)

Appendix 4:Company clusters based on ESMT Innovation Index 2014



Source: ESMT Analysis (2015)

Appendix 5: Timeline of exemplary initiatives of selected European utilities in the field of "diverse" innovation



Source: ESMT Analysis (2015)

Appendix 6: Interviews guidelines

Questions about Innovation Culture and Strategy

1. How would you define the desired outcome or purpose of EDP Innovation?
2. When is a project defined as success?
3. Which is your organization's (unit's) primary growth challenge?
4. How is EDP Innovation affecting the performance of the EDP Group?
5. Is there a mandate to encourage innovation inside of EDP Group? (incentive system?) What about specifically inside EDP-I?
6. In your opinion, what are the overall barriers to innovation culture in your organisation?

Questions about Innovation Process, Measurement, Evaluation

1. Do you differentiate between incremental and disruptive innovations - what are the respective metrics you use to define the different categories?
2. Do the metrics also differ between the different subsections (EDP Ventures, Cleaner Energy etc.)
3. Are projects initiated by technology push or market pull?
4. How often are projects killed? What is the metric to decide whether a project is killed or not and who decides this?
5. Can the average speed to market of innovations be determined at EDP innovation? Measure of efficiency of the pipeline?
6. What are the overall barriers to the innovation in terms of the process, measurement, or evaluation?

Questions concerning new KPI metrics

1. If you could introduce a new metric in order to measure the impact of innovation, how would it look like?
2. Is there a specific component that you believe should be included on the BSC?
3. On a scale from 1 to 10, as how useful would you assess the following KPIs:
    a. Number of new ideas deployed p.a.
    b. Number of new patents or trade secrets p.a.
    c. Royalty or licensing revenue from intellectual property p.a.
    d. Number of ideas turned into patents by employees p.a.
    e. Present Value of Innovations in the pipeline (how to measure in early stage?)
    f. Number of new patents/ideas in relation to total budget in €100k (or other useful in- and output KPIs in relation to each other)

g. Number of international partnerships with universities, public research etc.

h. Number of new products, services and businesses launched in the past year

i. Ratio of outside vs inside innovation processes

j. Actual vs. targeted time to market time

k. % of employees of EDP-I who have received training and tools for innovation management

l. Number of consequent innovations (innovations resulting from innovations)

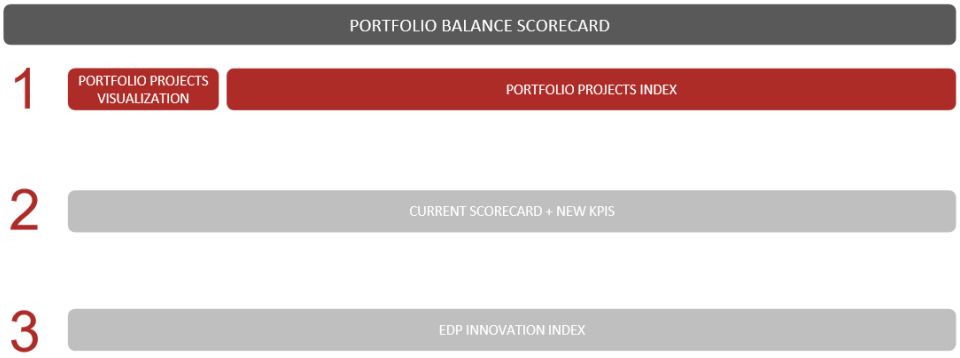
Questions for Engineers Pedro Valverde (Cleaner Energy), Pedro Ferreira (Smarter Grids), Andre Botelho (Energy Storage):

1. Do you work on multiple innovation projects at the same time?
2. Do you ever bring your expertise to other subsections of EDP-I?
3. To what extent are the other business units consulted about the innovations currently in the pipeline? Do you get feedback or do you ask for their input when you are developing new innovations?
4. How would you evaluate the communication across different business units?
5. Do you ever use the BSC? Do you think it is an effective tool to measure the innovation and success of the department?

Questions for Luis Manuel (Board Member and EDP Ventures):

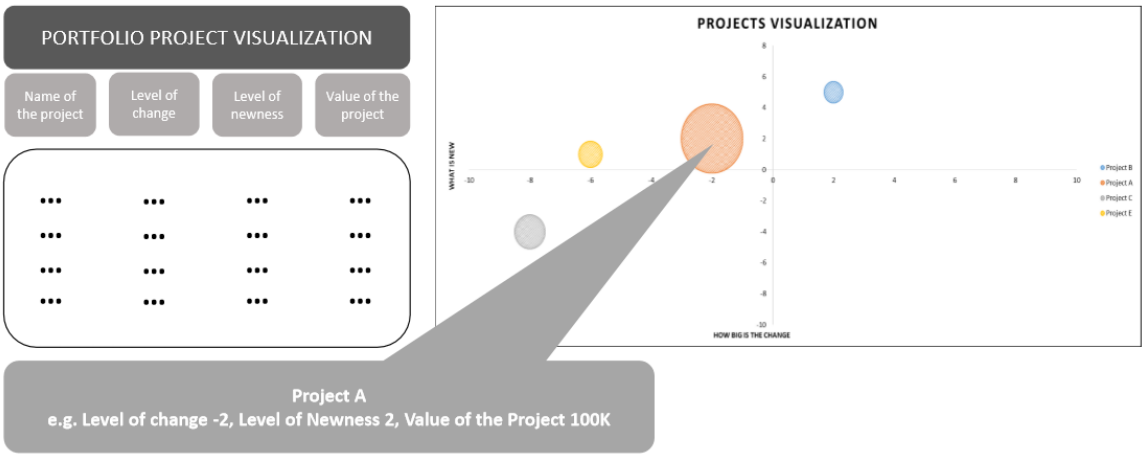
1. (Worked 8 years for Galp Energy):
    a. What were the common practices at Galp in terms of innovation measurement?
    b. Comparing Galp and EDP: Where is the innovation department better implemented?
2. Are all of the projects supported by EDP Ventures transferred to EDP's other business units? What is the project success rate?
3. What are currently the most important KPIs on the BS that you as a Board Member are looking at at first?
4. EDP Ventures: Are you tracking/measuring the performance of your investments in a way that is different from purely financial metrics?
5. EDP Ventures: How does the screening/ due diligence process look like and what are the key factors for the investment decision?
6. EDP Ventures: Is the ultimate goal of EDP Ventures profitability or having a long term impact on the group through new innovation? *Would you prefer 10% higher profitability or 10% better/higher long term impact for the EDP group?*

Appendix 7*:* Portfolio Balance Scorecard is composed of three elements: Project Visualization Index, Current Scorecard + New KPIs, EDP Innovation Index



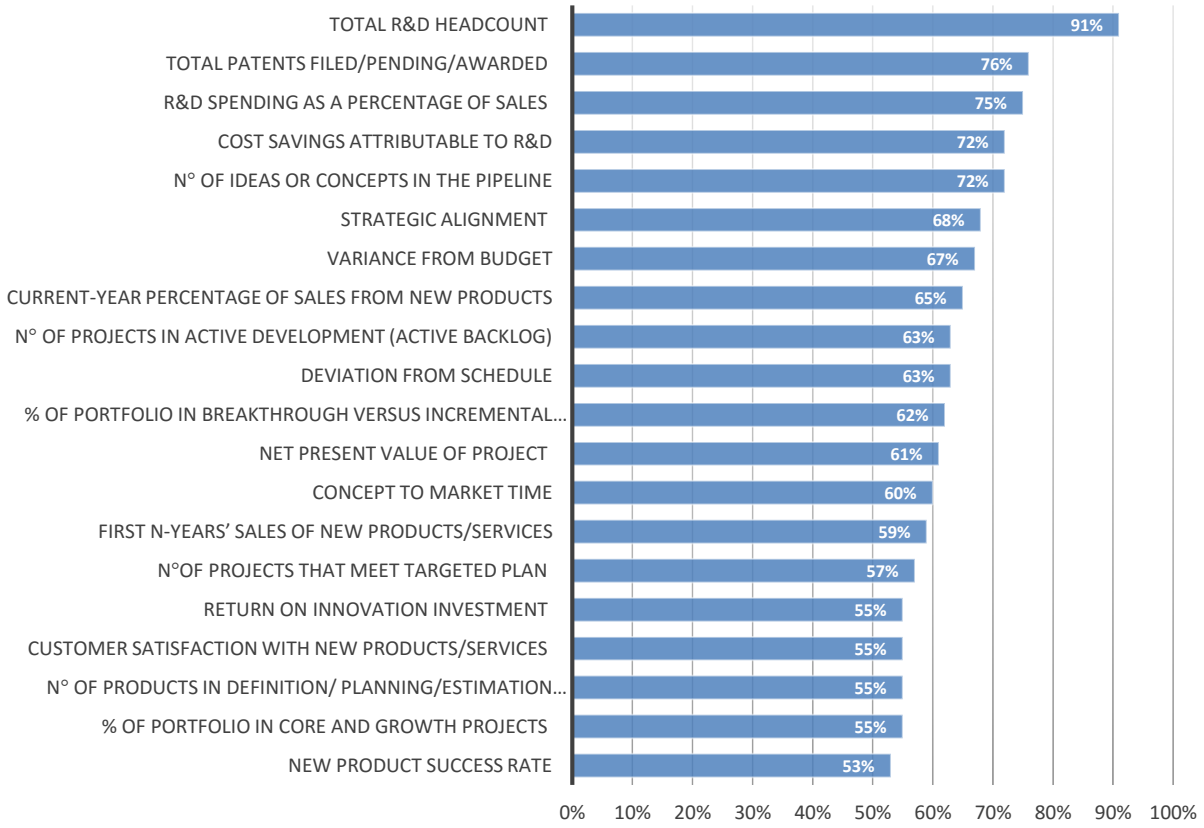
Source: Business Project

Appendix 8*:* Portfolio Projects Visualization ranks projects according to their level of change, their level of newness and their value in terms of €



Source: Business Project

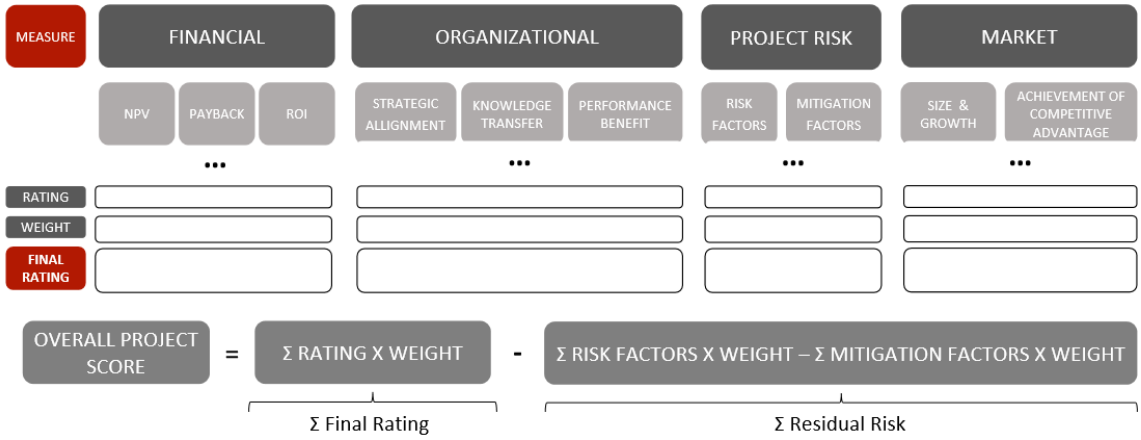
Appendix 8*:* Most commonly used KPIs in R&D



Source: CurrentState of R&D Metrics Complete Findings 24 March 2010, Research& Technology Executive Council of the Finance and StrategyPractice

Input	Process	Output
R&D & innovation spending Share of personnel involved % of time Innovation VS Ops Number of ideas generated Number of partnerships	Failure Rate From Idea to Approval – Average Time Ideas Approved VS Implemented Stage-gate pass rates Number of partnerships	# New Products or Services Revenue from New Prod or Service # New Customers # New Markets ROI on innovation spending

Appendix 9*:* The overall project score is given by: Σ Final Rating – Σ Residual Risk



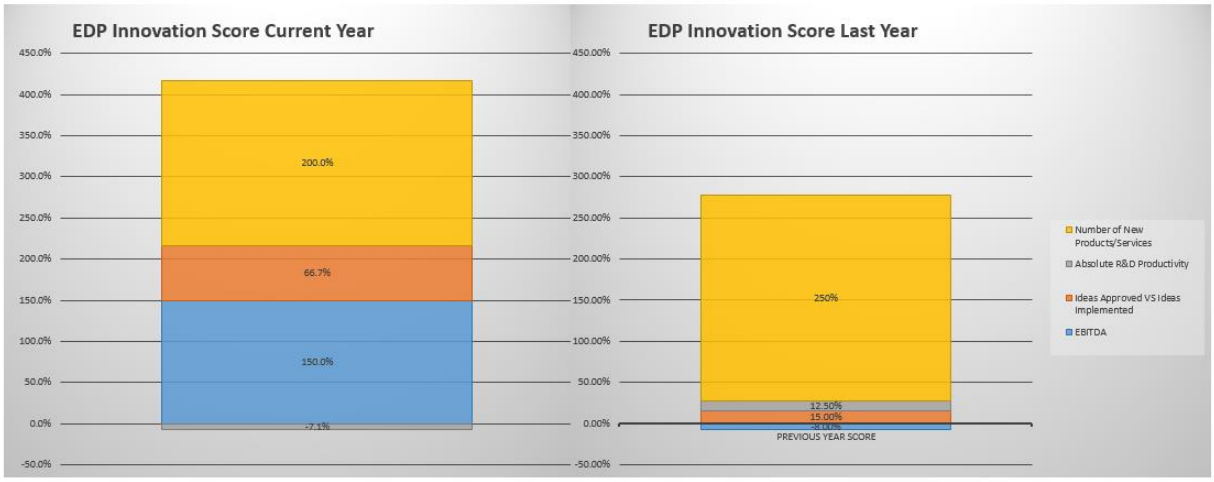
Source: Business Project

Appendix 10*:* The EDP Innovation Index – Example

Indicators	Weight	Budgeted	Actual	Indicator Score Current Year x Weight	Result Previous Year	Budgeted Previous Year	Indicator Score Previous Year X Weight
EBITDA	40%	-140	70	60%	-120	-100	-8%
Ideas Approved VS Idea Implemented	15%	3%	5%	10%	4%	2%	15%
Absolute R&D Productivity	25%	70%	65%	-1.8%	60%	40%	12,50%
Number of New Products or Services	20%	1	3	40%	7	2	50%
Sum	100%		Current EDP Innovation Score	108,2 %		Previous Year EDP Innovation Score	69,50%

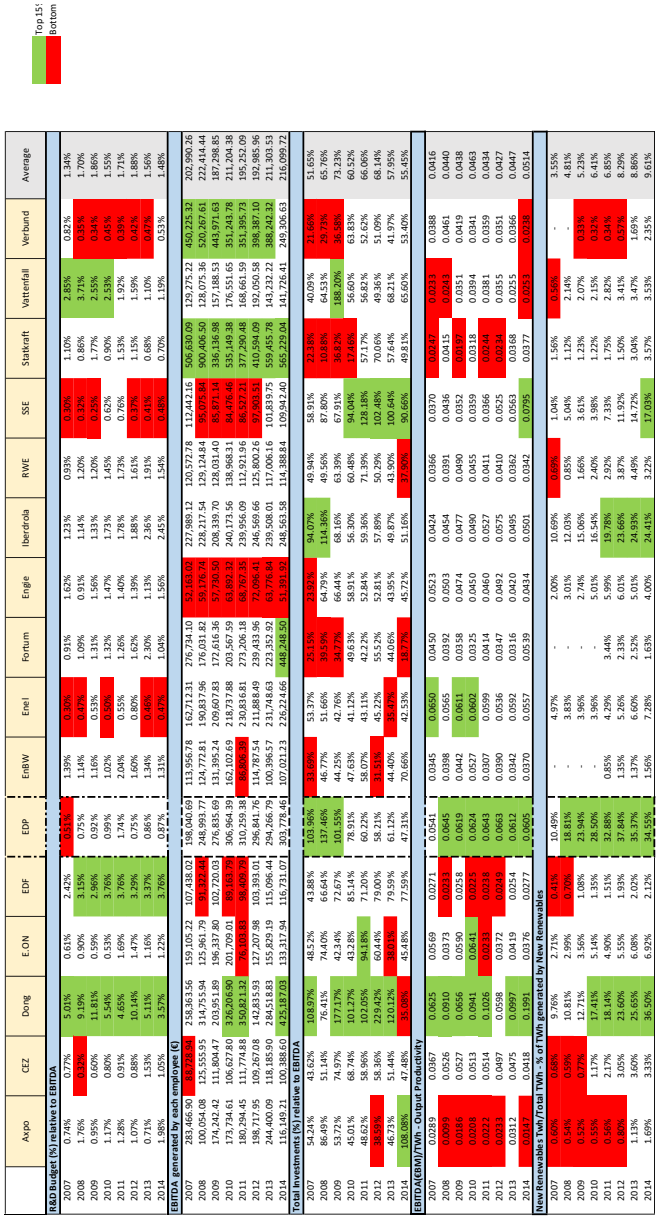
Source: Business Project

Appendix 11*:* The EDP Innovation Index – Example



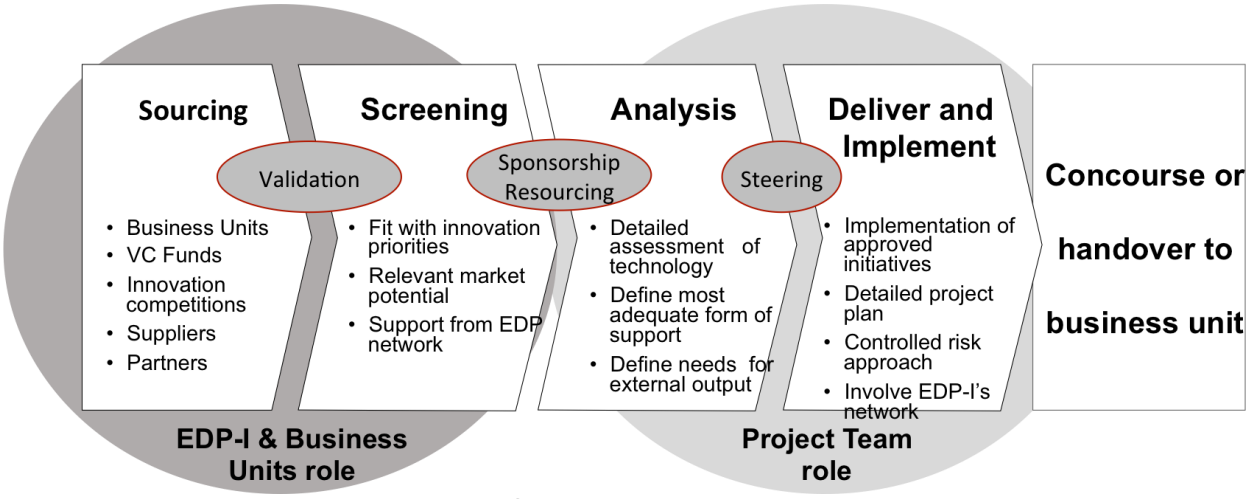
Source: Business Project

Appendix 12: Figures from competitive analysis



	Axpo	CEZ	Dong	E.ON	EDF	EDP	EnBW	Enel	Fortum	Engie	Iberdrola	RWE	SSE	Statkraft	Vattenfall	Verbund	Average
R&D Budget (%) relative to EBITDA																	
2007	0.74%	0.77%	5.01%	0.61%	2.42%	0.81%	1.39%	0.30%	0.91%	1.62%	1.23%	0.93%	0.30%	1.10%	2.85%	0.92%	1.34%
2008	1.76%	0.78%	9.19%	0.96%	3.15%	0.75%	1.14%	0.78%	1.09%	0.91%	1.14%	1.20%	0.32%	0.86%	3.71%	0.35%	1.70%
2009	1.93%	0.60%	11.81%	0.59%	2.76%	0.92%	1.16%	0.53%	1.33%	1.56%	1.33%	1.40%	0.62%	1.77%	2.53%	0.34%	1.66%
2010	1.73%	0.80%	11.84%	0.59%	2.76%	0.98%	1.10%	0.55%	1.32%	1.47%	1.73%	1.40%	0.62%	1.97%	2.53%	0.33%	1.55%
2011	1.28%	0.91%	4.65%	1.69%	3.76%	1.74%	2.04%	0.55%	1.26%	1.40%	1.78%	1.73%	0.76%	1.53%	1.92%	0.39%	1.71%
2012	1.07%	0.88%	10.14%	1.47%	3.29%	0.75%	1.60%	0.82%	1.62%	1.39%	1.88%	1.61%	0.37%	1.15%	1.59%	0.42%	1.88%
2013	0.71%	1.53%	5.11%	1.16%	3.37%	0.86%	1.34%	0.48%	2.30%	1.13%	2.36%	1.91%	0.41%	0.68%	1.10%	0.47%	1.56%
2014	1.98%	1.05%	3.57%	1.22%	3.76%	0.87%	1.31%	0.47%	1.04%	1.56%	2.45%	1.54%	0.48%	0.70%	1.19%	0.53%	1.48%
EBITDA generated by each employee (€)																	
2007	283,466.90	83,728.98	258,363.56	159,105.22	107,438.02	198,040.69	113,956.78	162,712.31	276,734.10	52,163.02	227,989.12	120,572.78	112,442.16	506,630.09	129,275.22	450,225.32	202,960.26
2008	100,054.08	125,555.95	314,755.94	125,961.79	91,222.44	248,993.77	124,772.81	190,837.96	176,031.82	59,176.74	228,217.54	129,124.84	95,075.84	900,406.50	128,075.36	520,267.61	222,414.44
2009	174,242.42	111,804.47	203,951.89	196,337.80	102,720.03	276,835.69	131,395.24	209,607.83	172,616.36	57,730.50	208,339.70	128,031.40	85,871.14	336,136.98	157,188.53	443,971.63	187,298.85
2010	173,734.61	106,627.80	326,206.90	201,709.01	89,163.75	306,964.39	162,102.69	218,737.88	203,567.59	63,892.32	240,173.56	138,968.31	84,476.46	535,149.38	176,551.65	351,243.78	211,204.38
2011	180,294.45	111,774.88	350,821.32	76,303.83	58,409.79	310,259.38	86,806.38	230,836.81	273,206.18	68,767.35	239,956.09	112,921.96	86,527.21	377,290.48	168,661.59	351,395.73	195,252.09
2012	198,717.95	109,267.08	142,835.93	127,207.98	103,393.01	296,841.76	114,787.54	211,888.49	239,433.96	72,056.41	246,569.66	125,800.26	97,503.51	410,594.09	192,050.58	398,387.10	192,985.96
2013	244,400.09	118,185.90	284,518.83	155,829.19	115,096.44	294,266.79	100,396.57	231,748.63	233,352.92	63,776.64	239,508.01	117,006.16	101,839.75	559,455.78	143,232.22	388,242.32	211,303.53
2014	116,149.21	100,388.60	425,187.03	133,317.94	116,731.07	303,778.46	107,021.23	226,224.66	448,248.50	51,391.52	248,563.58	114,388.84	109,942.40	565,229.04	141,726.41	249,306.63	216,099.72
Total investments (%) relative to EBITDA																	
2007	54.24%	43.62%	108.97%	48.52%	43.88%	103.96%	33.68%	53.37%	25.15%	23.91%	94.07%	49.94%	58.91%	22.38%	40.09%	21.66%	51.65%
2008	86.49%	51.14%	76.41%	74.40%	66.64%	137.46%	46.77%	51.66%	39.59%	64.79%	114.36%	49.56%	87.80%	10.88%	64.53%	29.73%	65.76%
2009	53.72%	74.97%	177.17%	42.34%	72.67%	101.55%	44.25%	42.76%	34.77%	66.44%	68.16%	63.39%	67.91%	36.82%	188.20%	36.58%	73.23%
2010	45.01%	68.74%	101.27%	43.28%	85.14%	78.91%	47.63%	41.12%	49.63%	58.91%	56.30%	60.48%	94.04%	17.46%	56.60%	63.83%	60.52%
2011	48.62%	58.96%	102.05%	94.18%	71.20%	60.22%	58.07%	43.11%	42.22%	52.84%	59.36%	71.39%	128.18%	57.17%	56.82%	52.62%	66.06%
2012	38.39%	58.36%	229.42%	60.44%	79.00%	58.21%	31.51%	45.22%	55.52%	52.81%	57.89%	50.29%	103.48%	70.06%	49.36%	51.09%	68.14%
2013	46.73%	51.44%	120.12%	180.81%	79.59%	61.12%	44.40%	58.49%	44.06%	43.95%	49.87%	43.90%	100.64%	57.64%	68.21%	41.97%	57.95%
2014	108.08%	47.48%	35.08%	45.48%	77.59%	47.31%	70.66%	42.53%	38.73%	45.72%	51.16%	37.80%	90.66%	49.81%	65.60%	53.40%	55.45%
EBITDA(€M)/TWh - Output Productivity																	
2007	0.0269	0.0367	0.0625	0.0569	0.0271	0.0541	0.0345	0.0650	0.0430	0.0523	0.0424	0.0366	0.0370	0.0237	0.0233	0.0388	0.0416
2008	0.00939	0.0526	0.0910	0.0373	0.0233	0.0645	0.0398	0.0565	0.0392	0.0503	0.0454	0.0391	0.0436	0.0415	0.0243	0.0461	0.0440
2009	0.00186	0.0527	0.0656	0.0590	0.0258	0.0619	0.0442	0.0611	0.0358	0.0474	0.0477	0.0490	0.0352	0.0351	0.0419		0.0438
2010	0.00238	0.0513	0.0941	0.0641	0.0225	0.0624	0.0527	0.0669	0.0325	0.0450	0.0490	0.0455	0.0359	0.0318	0.0394	0.0341	0.0463
2011	0.00213	0.0514	0.0785	0.0233	0.0183	0.0643	0.0297	0.0669	0.0314	0.0460	0.0527	0.0411	0.0266	0.0181	0.0381	0.0359	0.0414
2012	0.0013	0.0497	0.0598	0.0372	0.0218	0.0668	0.0090	0.0536	0.0014	0.0492	0.0575	0.0410	0.0525	0.0134	0.0355	0.0351	0.0427
2013	0.0312	0.0475	0.0697	0.0419	0.0254	0.0612	0.0342	0.0592	0.0316	0.0420	0.0495	0.0362	0.0563	0.0168	0.0255	0.0366	0.0447
2014	0.0147	0.0418	0.1991	0.0376	0.0277	0.0605	0.0370	0.0557	0.0539	0.0414	0.0501	0.0342	0.0795	0.0377	0.0253	0.0338	0.0514
New Renewables Twh/Total TWh - % of TWh generated by New Renewables																	
2007	6.66%	0.68%	9.76%	2.71%	0.41%	10.49%	-	4.97%	-	2.00%	10.69%	0.69%	1.04%	1.56%	0.58%	-	3.55%
2008	0.54%	0.59%	10.81%	2.99%	0.70%	18.81%	-	3.83%	-	3.01%	12.03%	0.85%	5.04%	1.12%	2.14%	-	4.81%
2009	0.52%	0.77%	12.71%	3.56%	1.08%	23.94%	-	3.96%	-	2.74%	15.06%	1.66%	3.61%	1.23%	2.07%	0.31%	5.23%
2010	0.55%	1.17%	17.41%	5.14%	1.35%	28.50%	-	3.96%	-	5.01%	16.54%	2.40%	3.98%	1.22%	2.15%	0.32%	6.41%
2011	0.56%	2.17%	18.14%	4.90%	1.51%	32.88%	0.85%	4.29%	3.44%	5.99%	19.78%	2.92%	7.33%	1.75%	2.82%	0.34%	6.85%
2012	0.80%	3.05%	23.60%	5.55%	1.93%	37.84%	1.35%	5.26%	2.33%	6.01%	23.66%	3.87%	11.92%	1.50%	3.41%	0.57%	8.29%
2013	1.13%	3.60%	25.65%	6.08%	2.02%	35.37%	1.37%	6.60%	2.52%	5.01%	24.93%	4.49%	14.72%	3.04%	3.47%	1.69%	8.86%
2014	1.69%	3.33%	36.50%	6.92%	2.12%	34.55%	1.56%	7.28%	1.63%	4.00%	24.41%	3.22%	17.03%	3.57%	3.53%	2.35%	9.61%

Appendix 13: EDP – I Structured Process



Source: Business Project